PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-320835
(43)Date of publication of application : 04.12.1998

(51)Int.Cl. G11B 7/24

(21)Application number : 09-128638
(22)Date of filing : 19.05.1997

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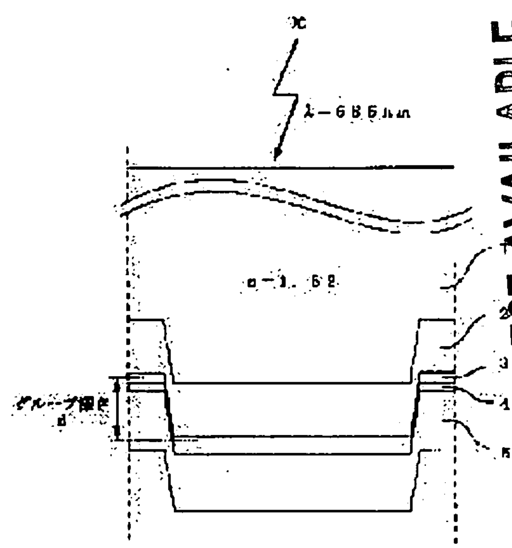
(54) OPTICAL DISK

(57)Abstract:
PROBLEM TO BE SOLVED: To dissolve the harmful effects owing to tending to narrowing track pitch regarding the phase change type optical disk to execute the land/groove recording.
SOLUTION: In the optical disk to record on the land part and the groove part making use of the phase change between amorphous and crystal, where the wave length of light is indicated by λ and the reflective index of disk substrate by n, the depth of groove, which is the difference in level between the land part and the groove part, is limited to a numerical range ≥λ/(3.78n). Further, the depth of groove is set near either of the values λ/(3n), {λ/(3n)+λ/(2n)} or {λ/(6n)+λ/(2n)}. Further, while deepening the depth of groove as mentioned above, the depth of surface roughness of the wall of groove is suppressed to ≤50 nm or ≤20 nm. The tapered angle of the wall of groove is set ≥60°, ≥80° or ≥84°.



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CLAIMS

[Claim(s)]
[Claim 1] The optical disk with which the groove depth which is the level difference of a land and the groove section is characterized by being lambda/(3.78n) above when wavelength of exposure light is set to lambda and the refractive index of a disk substrate is set to n in the optical disk which records, respectively that it is amorphous on a land and the groove section using the phase change during a crystal.
[Claim 2] The optical disk with which a track pitch is characterized by being narrower than 1.18lambda in an optical disk according to claim 1.
[Claim 3] The optical disk with which said groove depth is characterized by being in the range of lambda/(3.78n) - lambda/(1.13n) in an optical disk according to claim 1 or 2.
[Claim 4] The optical disk with which said groove depth is characterized by being lambda/(3n) in an optical disk according to claim 1 or 2.
[Claim 5] The optical disk with which said groove depth is characterized by being {lambda/(3n) +lambda/(2n)} in an optical disk according to claim 1 or 2.
[Claim 6] The optical disk with which said groove depth is characterized by being {lambda/(6n) +lambda/(2n)} in an optical disk according to claim 1 or 2.
[Claim 7] The optical disk with which rough width of face of a slot side attachment wall is characterized by being 50nm or less in an optical disk given in claim 1 thru/or any 1 term of 6.
[Claim 8] The optical disk with which rough width of face of a slot side attachment wall is characterized by being 20nm or less in an optical disk given in claim 1 thru/or any 1 term of 6.
[Claim 9] The optical disk with which the taper angle of a slot side attachment wall is characterized by being 60 degrees or more in an optical disk given in claim 1 thru/or any 1 term of 6.
[Claim 10] The optical disk with which the taper angle of a slot side attachment wall is characterized by being 80 degrees or more in an optical disk given in claim 1 thru/or any 1 term of 6.
[Claim 11] The optical disk with which the taper angle of a slot side attachment wall is characterized by being 84 degrees or more in an optical disk given in claim 1 thru/or any 1 term of 6.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the optical disk which raised properties, such as a rate of elimination, by setting up the groove depth proper about an optical disk.
[0002]
[Description of the Prior Art] An optical disk is put in practical use a noncommercial use, for computers, etc. as a bulk memory, and is spreading quickly. Since multimedia age is greeted and it corresponds to informational buildup and diversification, in the next-generation optical disk, the demand of over-writing-izing etc. is increasing to the further large-capacity-izing, improvement in the speed of a transfer rate, and a pan increasingly.
[0003] In order especially to double track density recently and to attain large capacity-ization, the method (henceforth "land groove record") which records a signal on the both sides of the land of an optical disk and the groove section attracts attention.
[0004]
[Problem(s) to be Solved by the Invention] In such land groove record, a track pitch becomes narrow to conventional one half extent.
[0005] Therefore, it is easy to generate the evil of the cross talk which the signal of an adjoining truck mixes in a regenerative signal at the time of playback, the cross erasion which erases the signal of an adjoining truck at the time of elimination, the cross light which overflows into an adjoining truck and records a signal. In the optical disk which repeats record playback especially, since cross erasion and the effect of a cross light are accumulated, the effect of the above-mentioned evil appears greatly.
[0006] Moreover, in order for the output of a regenerative signal itself to decline with the formation of a ** track pitch, the evil in which CNR (carrier-noise ratio) falls is also produced. Furthermore, an elimination property also falls with the formation of a ** track pitch. As a cause of lowering of an elimination property, a record mark is written in extent protruded to the limit of the narrow width of recording track, or a little, and is considered for erasing at the time of over-writing and producing the remainder.
[0007] For evil which was mentioned above, with the optical disk which performs land groove record, an about 0.8-0.7-micrometer track pitch is a limitation, and was considered that the formation of a ** track pitch beyond this is difficult. So, it aims at offering the optical disk which can make a track pitch still narrower in invention according to claim 1 to 3, solving the evil mentioned above.
[0008] in invention according to claim 4 to 6, it combines with the object of claim 1 and aims at offering the optical disk which can boil a cross talk markedly and can be decreased. It aims at offering the optical disk which solved the evil produced when the groove depth is made deeper than before in invention according to claim 7 to 11.
[0009]
[Means for Solving the Problem] In the optical disk which records, respectively that invention according to claim 1 is amorphous on a land and the groove section using the phase change during a crystal, when wavelength of exposure light is set to lambda and the refractive index of a disk substrate is set to n, it is characterized by carrying out the groove depth which is the level difference of a land and the groove section lambda/(3.78n) above.

[0010] According to such structure, the heat travelling distance between a land and the groove section becomes long. Therefore, the evil of the cross erasion which stops easily being able to spread the exposure heat of light to an adjoining truck, and is produced by heat propagation, a cross light, etc. is mitigated. Moreover, in an adjoining truck, a land and the groove section become easy to be covered with heat by being hard coming to spread heat. Therefore, in case a record mark is eliminated, it becomes possible to stop an amorphous mark long time near the crystallization temperature. Consequently, the crystallization effectiveness of an amorphous mark improves and the rate of elimination improves.
[0011] When a track pitch is about 0.6 micrometers by setting up the groove depth lambda/(3.78n) above especially, it becomes possible to secure the value of usable cross light resistance Pw/Pp (after-mentioned). The evil of the formation of a ** track pitch is mitigated by such operation, and it becomes possible to attain ** track pitch-ization of 0.6 micrometers or less.
[0012] It is characterized by invention according to claim 2 having a track pitch narrower than 1.18lambda in an optical disk according to claim 1. Invention according to claim 3 is characterized by the groove depth being in the range of lambda/(3.78n) - lambda/(1.13n) in an optical disk according to claim 1 or 2.
[0013] Invention according to claim 4 is characterized by the groove depth being lambda/(3n) in an optical disk according to claim 1 or 2. Thus, the cross talk from an adjoining truck can be made into the minimum by setting up the optical path difference between land-grooves. Invention according to claim 5 is characterized by the groove depth being {lambda/(3n) +lambda/(2n)} in an optical disk according to claim 1 or 2.
[0014] Thus, the cross talk from an adjoining truck can be made into the minimum by setting up the optical path difference between land-grooves. Invention according to claim 6 is characterized by the groove depth being {lambda/(6n) +lambda/(2n)} in an optical disk according to claim 1 or 2. Thus, the cross talk from an adjoining truck can be made into the minimum by setting up the optical path difference between land-grooves.
[0015] Invention according to claim 7 is characterized by the rough width of face of a slot side attachment wall being 50nm or less in an optical disk given in claim 1 thru/or any 1 term of 6. By making the groove depth deep, the playback noise resulting from the dry area of a slot side attachment wall increases. Then, it found out that a noise level was reduced and CNR45dB could be secured by holding down the rough width of face which was 150nm or more conventionally to a maximum of 50nm, as a result of experimenting this time. This value of CNR45dB is a value with which are satisfied of the value of standard of 45dB of CNR defined by an ISO standard etc.
[0016] Invention according to claim 8 is characterized by the rough width of face of a slot side attachment wall being 20nm or less in an optical disk given in claim 1 thru/or any 1 term of 6. By making the groove depth deep, the playback noise resulting from the dry area of a slot side attachment wall increases. Then, as a result of experimenting this time, it found out that a noise level was reduced and CNR48dB could be secured by holding down rough width of face to a maximum of 20nm. This value of CNR48dB is a value which secured the about 3dB margin to the value of standard of 45dB of CNR defined by an ISO standard etc.
[0017] Invention according to claim 9 is characterized by the taper angle of a slot side attachment wall being 60 degrees or more in an optical disk given in claim 1 thru/or any 1 term of 6. Usually, a slot side attachment wall gives a taper angle, and is formed. Therefore, the width of face of the slot side attachment wall seen from the optical pickup spreads as the groove depth is made deep. Since it is overflowed and recorded on the signal fang furrow side attachment wall from the truck of both sides at this time, cross light resistance gets worse by the cross light to a slot side attachment wall.
[0018] Then, as a result of experimenting this time, it found out that one or more values usable for cross light resistance were securable by making a taper angle into 60 degrees or more. Invention according to claim 10 is characterized by the taper angle of a slot side attachment wall being 80 degrees or more in an optical disk given in claim 1 thru/or any 1 term of 6. As a result of experimenting this time, it found out that 1.1 or more values usable for cross light resistance were securable enough by making a taper angle into 80 degrees or more.
[0019] Invention according to claim 11 is characterized by the taper angle of a slot side attachment wall being 84 degrees or more in an optical disk given in claim 1 thru/or any 1 term of 6. As a result of

experimenting this time, it found out that cross light resistance improved rapidly by making a taper angle into 84 degrees or more.
[0020]
[Embodiment of the Invention] Hereafter, the gestalt of the operation in this invention is explained based on a drawing.
[0021] Drawing 1 is the sectional view showing the basic structure (quenching structure) of the phase-change optical disk produced this time. In drawing 1 , the disk substrate 1 is glass 2P disc-like substrate (refractive index n= 1.52) which consists of 1.2mm in the diameter of 86mm, the bore of 15mm, and thickness, and the slot which makes a land and the groove section is formed in the front face in the shape of a spiral. The groove depth at this time is set as a value (120nm or more) deeper than the conventional groove depth (40-85nm).
[0022] A protective layer 2, the record layer 3, a protective layer 4, and a reflecting layer 5 are formed in the front face of this disk substrate 1 in order. First, a protective layer 2 is a layer of 135nm of thickness which consists of ZnS-SiO2. The record layer 3 is a layer of 25nm of thickness which consists of an alloy of GeSbTe. A protective layer 4 is a layer of 20nm of thickness which consists of ZnS-SiO2. A reflecting layer 5 is a layer of 150nm of thickness which consists of aluminum.
[0023] On the other hand, the wavelength lambda of a laser beam is 685nm, and the numerical aperture (NA) of an objective lens of the optical pickup (not shown) used for assessment measurement of an optical disk is 0.6. Hereafter, the property of an optical disk is explained for every measurement result. (Rate of elimination at the time of over-writing) According to the following procedure, the rate of elimination was measured for the optical disk which set the track pitch as 0.6 micrometers and set the groove depth as 160nm.
[0024] (1) Record 3T mark.
(2) Reproduce the 3T mark.
(3) Record 8T mark on it.
After repeating above-mentioned procedure (1) - (3) 1000 times, 3T mark is recorded eventually. When this optical disk is played, the ratio of 8 T component in a regenerative signal (erasing remainder at the time of over-writing) and 3 T component is measured, and it considers as the rate of elimination.
[0025] drawing 2 is drawing having shown the value of the rate of elimination at the time of boiling and setting up various elimination power. The round mark in drawing shows the rate of elimination in the conventional optical disk (groove depth = 40nm), and the triangle mark shows the rate of elimination in the optical disk (groove depth = 160nm) of this operation gestalt. On the whole about 3-10dB in drawing 2 , the rate of elimination of the optical disk of this operation gestalt is improving compared with the conventional optical disk.
[0026] Therefore, if the rate of elimination of 30dB or more is considered to be the real activity range, for example, the fluctuation margin of elimination power can be expanded further and can secure **35.5% of fluctuation margin from **6 conventional% in this operation gestalt. Hereafter, some explanation is tried about the reason whose rate of elimination at the time of over-writing improves.
[0027] First, the heat travelling distance between a land and the groove section becomes long by making the groove depth deep. Consequently, it is hard coming to spread the exposure heat of light to an adjoining truck, and heat becomes easy to concentrate it in a truck. Consequently, it is restricted to the almost same range, and a mark periphery etc. erases and the breadth of the heat at the time of record and elimination is considered to be hard coming to generate the remainder compared with the former.
[0028] Moreover, when the heat travelling distance between a land and the groove section becomes long, heat becomes easy to collect on a truck. Therefore, in case a record mark is eliminated, it becomes possible to stop an amorphous part long time near the crystallization temperature. Consequently, it is thought that the crystallization effectiveness of an amorphous part improves and the rate of elimination improves. As mentioned above, since the rate of elimination is improved by making the groove depth deep, it becomes possible to attain much more formation of a ** track pitch, and high transfer rate-ization.
[0029] Next, another measurement result is explained.
(Cross light resistance) Cross light resistance is measured according to the following procedure. First, the whole optical disk is made into the crystal structure (elimination condition). A part for one truck on the land of this optical disk is received, and it is linear velocity 5 m/sec. In the condition, a single

frequency record bit with a die length of 0.4 micrometers is recorded.
[0030] At this time, the value of the record power from which CNR and the rate of elimination become the optimal is calculated, and it considers as the optimal record power Pp. Next, the single frequency about 100 times number record bit of 0.43-micrometer die length is recorded to the groove section of adjoining both sides, respectively. Then, it returns to a land and CNR is measured.
[0031] At this time, the value of the record power Pw from which CNR of a land begins (0.5dB down) to fall is calculated. here -- the ratio of record power -- Pw/Pp is computed and it considers as cross light resistance. When this cross light resistance Pw/Pp is less than one and a predetermined truck is recorded by the optimal record power Pp, by adjoining truck, a cross light will be generated and CNR will fall by 0.5dB or more. Therefore, when cross light resistance Pw/Pp is less than one, it is not mostly suitable for practical use.
[0032] On the other hand, when cross light resistance Pw/Pp is one or more, in case a predetermined truck is recorded by the optimal record power Pp, the lowering of CNR in an adjoining truck can be suppressed to 0.5dB or less. Therefore, cross light resistance Pw/Pp serves as range which can use the range which becomes one or more. In order to expect the fluctuation margin of record power, a certain thing of cross light resistance Pw/Pp is [1.1 or more] actually, desirable.
[0033] drawing 3 is the result of measuring cross light resistance Pw/Pp about the optical disk which boiled and set up various track pitches and groove depth, respectively. Cross light resistance Pw/Pp improves as are shown in drawing 3 and the groove depth is made deep. Here, when a track pitch is 0.6 micrometers, it becomes possible by setting the groove depth as 120nm or more to secure one or more values usable for cross light resistance Pw/Pp.
[0034] That is, a track pitch 0.6 micrometers or less is realizable further across a conventionally possible track pitch 0.7micrometer limitation by setting the groove depth to 120nm or more. lambda/(3.78n) can be found by setting wavelength of a laser beam to lambda for 120nm of critical conditions of such the groove depth, and converting it optically, using the refractive index of a disk substrate as n.
[0035] Drawing 4 is drawing having shown the relation between a track pitch and cross light resistance Pw/Pp based on the same measurement result as drawing 3 . It becomes possible to secure usable cross light resistance Pw/Pp, narrowing a track pitch to 0.53 micrometers, when the groove depth is set as 160nm, as shown in drawing 4 .
[0036] Furthermore, when the groove depth is set as 200nm, even if it narrows a track pitch to 0.5 micrometers or less, it becomes possible to secure usable cross light resistance Pw/Pp.
[0037] Next, another measurement result is explained.
(Cross talk) Conventionally, when the groove depth is set as lambda/(6n) extent in a land groove recording method, it is known that the cross talk from an adjoining truck can be done in the minimum.
[0038] It faced setting up the groove depth lambda/(3.78n) above this time, and the point which makes a cross talk the minimum was newly considered. Consequently, it found out that a cross talk became the minimum for the first time by setting up groove depth d near the following value.
D=lambda/(3n) ... (1)
D=lambda/(6n) +lambda/(2n) ... (2)
D=lambda/(3n) +lambda/(2n) ... (3)
Furthermore, the general value of groove depth d from which a cross talk serves as the minimum is d=lambda/(3n) +plambda/(2n) as a result of optical count. ... (4)
(However, a multiplier p= 0, 1, 2 ...)
D=lambda/(6n) +mlambda/(2n) ... (5)
(-- a multiplier m= 0, and 1 and 2 ...) -- ** -- what is expressed was found out for the first time.
[however,]
[0039] Drawing 5 is drawing showing the relation between the groove depth and a cross talk. In addition, the black dot shown in drawing 5 is measured value, and a continuous line is calculated value. In drawing 5 , it is the neighborhood (a groove depth of d= 135nm, 310nm, and 360nm), and a cross talk becomes the minimum. These values are located near the value called for from the above-mentioned (1) - (3) type, respectively.
[0040] Thus, by setting up groove depth d, it becomes possible to control generating of a cross talk effectively. Drawing 6 is drawing having shown the result of having measured the cross talk with change of record power. the round mark shown in drawing 6 is the measurement data at the time of it

being alike as usual and setting the groove depth as lambda/(6n), and the triangle mark shown in drawing 6 is the measurement data at the time of setting the groove depth as lambda/(3n).
[0041] As shown in drawing 6 , when the groove depth is lambda/(3n), even if it changes record power sharply, change is hardly looked at by the cross talk. This is considered because it is restricted by the flash fang furrow side attachment wall of record mark width of face by making the groove depth deep. Therefore, by setting up groove depth d by the above-mentioned (1) - (3) type shows that a cross talk can be strongly controlled under an ill condition to which the record power of about [being usually effective in the cross talk control at the time] and the optical pickup section is changed sharply.
[0042] Next, another measurement result is explained.
(Dry area of a slot side attachment wall) Drawing 7 is an electron microscope photograph on the front face of a stamper. The rough width of face of drawing 7 (a) of a slot side attachment wall is the case of about 150nm. On the other hand, the rough width of face of drawing 7 (b) of a slot side attachment wall is the case of 20nm or less. In addition, the stamper of drawing 7 (b) was produced by rationalizing each factor by trial and error about a known mastering process.
[0043] Drawing 8 is drawing showing the improvement effect by rough reduction of a slot side attachment wall. As shown in drawing 8 , by 150nm or more, the noise level of a playback noise is set to (-60dBm), and, as for CNR, the rough width of face of a slot side attachment wall is set to 42dB. On the other hand, by 50nm or less, the noise level of a playback noise improves to (-63dBm), and, as for CNR, the rough width of face of a slot side attachment wall is improved by 45dB.
[0044] Furthermore, if the rough width of face of a slot side attachment wall is held down to 20nm or less, the noise level of a playback noise will improve to (-66dBm), and CNR will be improved by 48dB. Next, another measurement result is explained.
(Taper angle of a slot side attachment wall) Drawing 9 is drawing for defining the taper angle of a slot side attachment wall.
[0045] Here, as shown in drawing 9 , the acute angle theta which Men of a slot side attachment wall and the plate surface of a disk make is defined as a taper angle. drawing 10 is drawing having shown cross light resistance Pw/Pp at the time of boiling and setting up various taper angles. In addition, the groove depth of the optical disk used for measurement is 180nm.
[0046] it is shown in drawing 10 -- as -- a taper angle -- being steep (it bringing close to 90 degrees) -- it carries out -- it is alike, and it follows and cross light resistance Pw/Pp improves. The width of face of the slot side attachment wall seen from the optical pickup becomes narrow, and this is considered for the amount of [to a slot side attachment wall] cross light to decrease as a taper angle is made steep. When a taper angle is especially set as 60 degrees or more, also in track pitch 0.5micrometer, one or more values usable for cross light resistance can be secured. ✓
[0047] Moreover, when a taper angle is set as 80 degrees or more, also in track pitch 0.5micrometer, 1.1 or more values usable for cross light resistance can be secured. Furthermore, since the width of face of the slot side attachment wall seen from the track pitch serves as extent which can be disregarded when a taper angle is set as 84 degrees or more, cross light resistance improves rapidly. In addition, with the operation gestalt mentioned above, although explained centering on the optical disk (drawing 1) of quenching structure, this invention is not limited to the optical disk of quenching structure.
[0048] For example, the optical disk of annealing structure can be formed by thick-film-izing the 2nd protective layer 4 to about 200 micrometers, or thin-film-izing the reflecting layer 5 which is a radiator as shown in drawing 11 to about 20nm.
[0049] In the optical disk of such annealing structure, the operation effectiveness by making the groove depth deep can be acquired similarly. For example, the white triangle mark shown in drawing 4 is the measurement data about the optical disk of annealing structure. In such measurement data, the data of the almost same inclination as the optical disk of quenching structure are obtained. Moreover, with the operation gestalt mentioned above, although glass is used for the disk substrate 1, it is not limited to this construction material. What is necessary is just the construction material which has properties, like thermal resistance is good, and water absorption is generally low, and there is little curvature. For example, a polycarbonate, polymethylmethacrylate, polyolefine system resin, etc. may be used.
[0050] Furthermore, with the operation gestalt mentioned above, although ZnS-SiO2 is used as protective layers 2 and 4, it is not limited to this construction material. Generally, are transparent and what is necessary is just stable construction material thermally. For example, the oxide of a metal or

semimetal, a nitride, a chalcogen ghost, a fluoride, carbide, etc. may be used. Moreover, although the alloy which consists of GeSbTe as a record layer 3 is used with the operation gestalt mentioned above, it is not limited to this construction material. Generally, a stable amorphous condition is maintained at a room temperature, and optical change should just be large construction material between an amorphous condition and a crystallized state. For example, InSbTe, InSbTeAg, GaSb, InGaSb, GeSnTe, AgSbTe, etc. may be used.

[0051] Furthermore, with the operation gestalt mentioned above, although aluminum is used for a reflecting layer 5, it is not limited to this construction material. Generally, what is necessary is just the metal membrane which reflects light. For example, Au, Ti, nickel, Cu, Cr, Si, etc. may be used. Moreover, it can also consider as the structure where a reflecting layer 5 is not used, by adjusting the thickness and the refractive index of other layers.

[0052] Moreover, it is good also as an optical disk of the structure which added SiO two-layer with a small coefficient of thermal expansion between the dielectric protective layer 4 and the reflecting layer 5. Furthermore, the optical disk of the structure which added the protective layer of SiO two-layer +ZnS-SiO2 grade between the dielectric protective layer 4 and the reflecting layer 5 is sufficient.

[0053] Furthermore, the optical disk of the structure which added reflecting layers, such as Au, between the substrate 1 and the dielectric protective layer 2 is sufficient. Moreover, with the operation gestalt mentioned above, although wavelength lambda of the laser beam of the optical pickup section is set to 685nm, it is not limited to this wavelength. For example, wavelength lambda of a laser beam may be short-wavelength-ized to about 410nm.

[0054]

[Effect of the Invention] As explained above, since the groove depth is set up lambda/(3.78n) above, by invention according to claim 1 to 3, the heat travelling distance between a land and the groove section becomes long. Consequently, the cross erasion and the cross lights which stop easily being able to spread the exposure heat of light to an adjoining truck, and are produced by heat propagation decrease in number.

[0055] Moreover, heat becomes easy to collect on a truck by being hard coming to spread heat on an adjoining truck. Therefore, in case a record mark is eliminated, it becomes possible to stop an amorphous part near the crystallization temperature for a long time. Consequently, the crystallization effectiveness of an amorphous part improves and the rate of elimination improves. Furthermore, it became clear that the fluctuation margin of elimination power or record power is expandable by making the groove depth of an optical disk deep from this measurement result.

[0056] By limiting the groove depth lambda/(3.78n) above especially, when a track pitch is 0.6 micrometers, it becomes possible to secure one or more values usable for cross light resistance Pw/Pp. In invention according to claim 4, the groove depth is set as lambda/(3n). such -- what -- the cross talk from an adjoining truck can be made into the minimum by setting up the optical path difference between land-grooves.

[0057] In invention according to claim 5, the groove depth is set as {lambda/(3n) +lambda/(2n)}. Thus, the cross talk from an adjoining truck can be made into the minimum by setting up the optical path difference between land-grooves. In invention according to claim 6, the groove depth is set as {lambda/(6n) +lambda/(2n)}. Thus, the cross talk from an adjoining truck can be made into the minimum by setting up the optical path difference between land-grooves.

[0058] In invention according to claim 7, since the rough width of face of a slot side attachment wall is set as 50nm or less, it becomes possible to reduce the level of a playback noise and to secure about CNR45dB. This value of CNR45dB is a value with which are satisfied of the value of standard of 45dB of CNR defined by an ISO standard etc. In invention according to claim 8, since the rough width of face of a slot side attachment wall is set as 20nm or less, it becomes possible to reduce the level of a playback noise and to secure CNR48dB. This value of CNR48dB is a value which can secure an about 3dB margin to the value of standard of 45dB of CNR defined by an ISO standard etc.

[0059] In invention according to claim 9, since the taper angle of a slot side attachment wall is set as 60 degrees or more, the width of face of the slot side attachment wall seen from the optical pickup does not spread so much, but can secure one or more values usable for cross light resistance. Since invention according to claim 10 sets the taper angle of a slot side attachment wall as 80 degrees or more, the width of face of the slot side attachment wall seen from the optical pickup does not spread, but can secure

enough 1.1 or more values usable for cross light resistance.
[0060] Since invention according to claim 11 sets the taper angle of a slot side attachment wall as 84 degrees or more, the width of face of the slot side attachment wall seen from the optical pickup can serve as extent which can be disregarded, and can raise cross light resistance rapidly. As explained above, in the optical disk which applied this invention, the evil accompanying the formation of a ** track pitch can be reduced exactly. Therefore, ** track pitch-ization more than before is attained and it becomes possible to attain large-capacity-izing of an optical disk, a miniaturization, etc.

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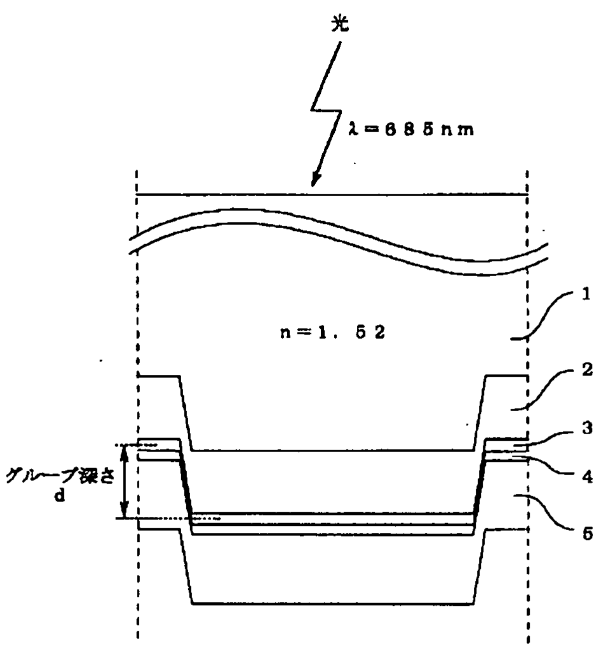
DRAWINGS

[Drawing 1]

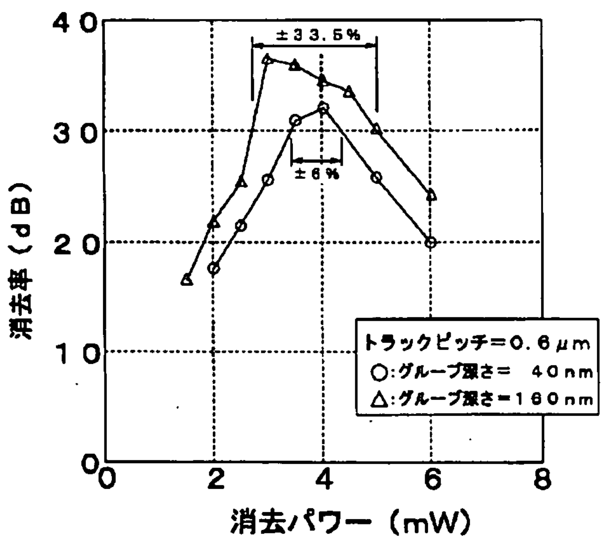
本実施形態における光ディスクの構造を示す断面図



1・・ディスク基板（SiO_2）　1．2mm
2・・保護層（$ZnS-SiO_2$）　135nm
3・・記録層（GeSbTe）　25nm
4・・保護層（ZnS－SiO　）　20nm
5・・反射層（Al）　150nm

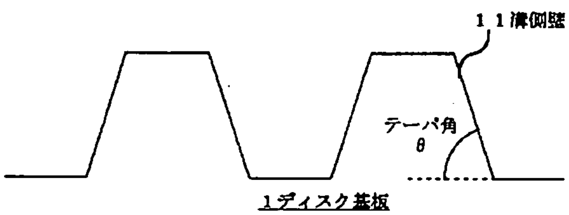
[Drawing 2]

オーバーライト時における
消去パワーと消去率との関係を示す図



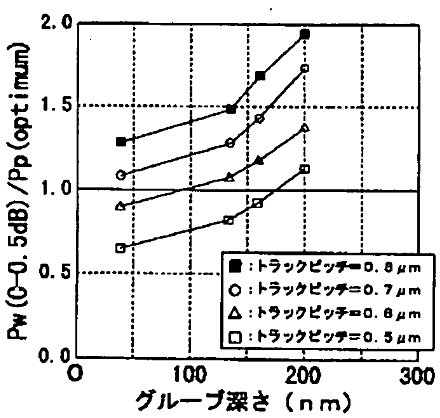
[Drawing 9]

溝側壁のテーパ角を説明する図



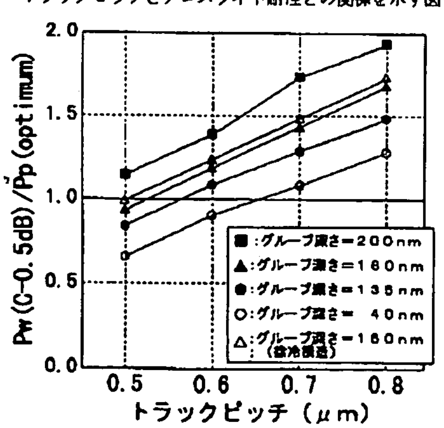
[Drawing 3]

グルーブ深さとクロスライト耐性との関係を示す図



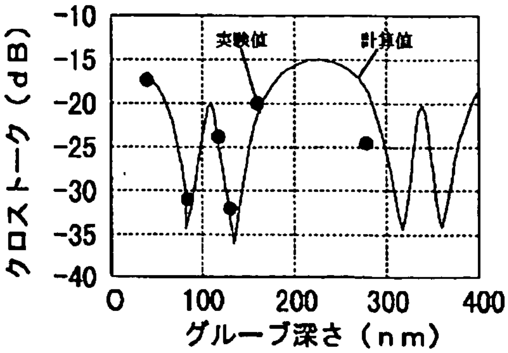
[Drawing 4]

トラックピッチとクロスライト耐性との関係を示す図



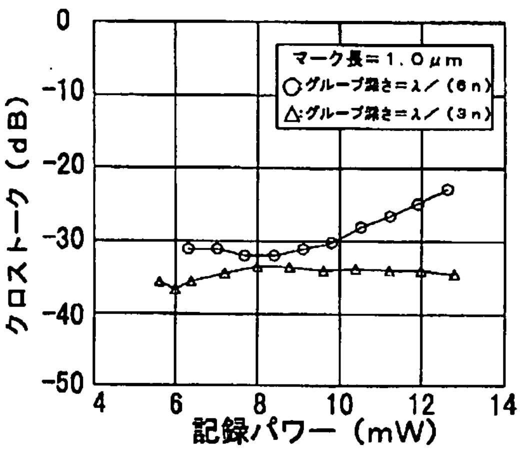
[Drawing 5]

グループ深さとクロストークとの関係を示す図



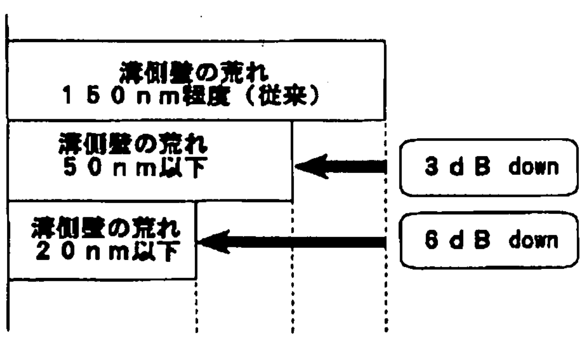
[Drawing 6]

記録パワーとクロストークとの関係を示す図



[Drawing 8]

溝側壁の荒れ低減による改善効果を示す図

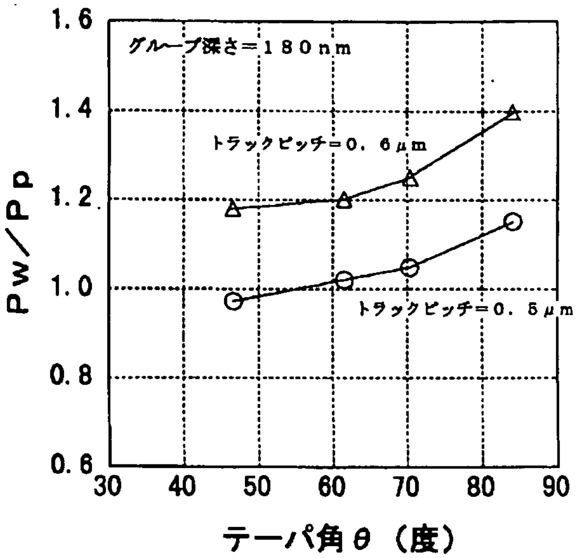


ノイズレベル［dBa］	－６６	－６３	－６０
ＣＮＲ［ｄＢ］	４８	４５	４２

グルーブ深さ＝１８０ｎｍ
トラックピッチ＝０．５μｍ

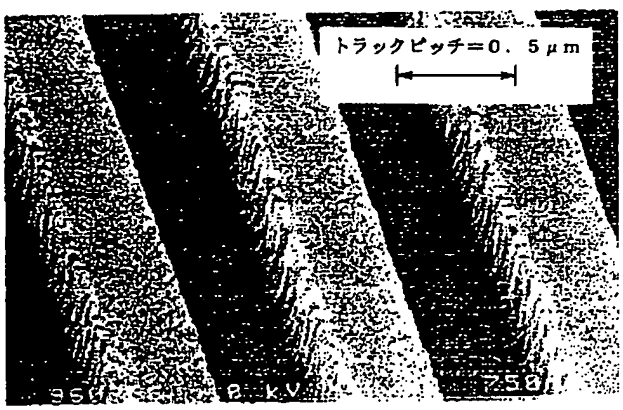
[Drawing 10]

テーパ角とクロスライト耐性との関係を示す図

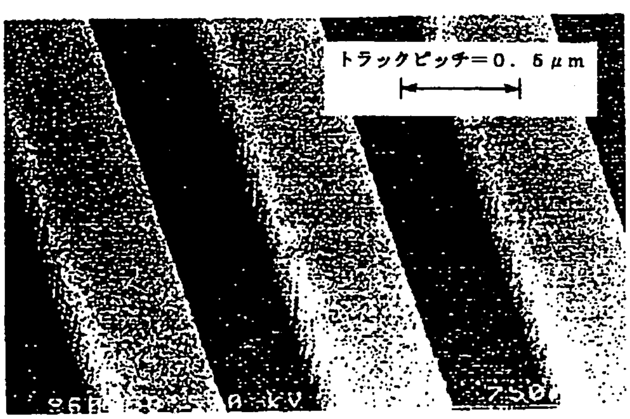


[Drawing 7]

スタンパー表面の顕微鏡写真



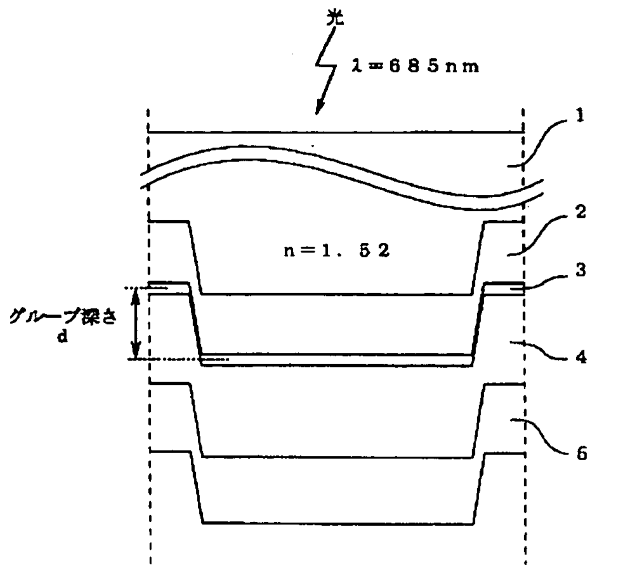
（ａ）溝側壁の荒れ１５０ｎｍ程度



（ｂ）溝側壁の荒れ２０ｎｍ以下

[Drawing 11]

別の光ディスク（徐冷構造）を示す断面図



1・・ディスク基板（SiO_2） 1．2mm
2・・保護層（$ZnS-SiO_2$） 135nm
3・・記録層（GeSbTe） 25nm
4・・保護層（ZnS−SiO ） 200nm
5・・反射層（Al） 150nm

[Translation done.]

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